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A Weekly Journal Devoted to Industrial and Engineering Chemistry

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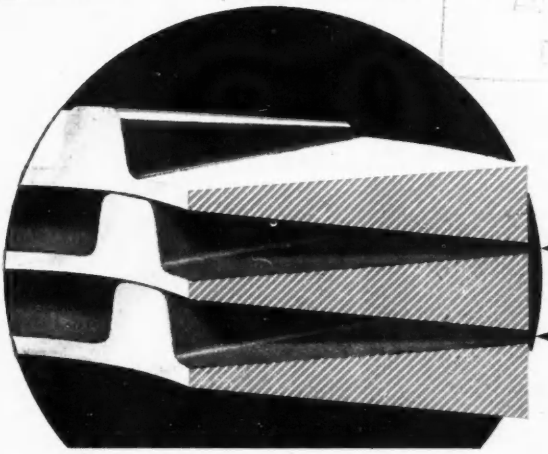

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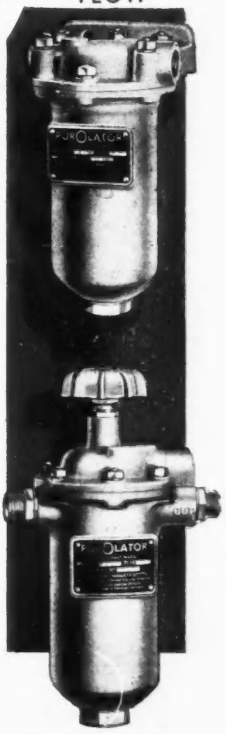

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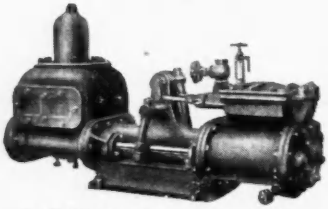

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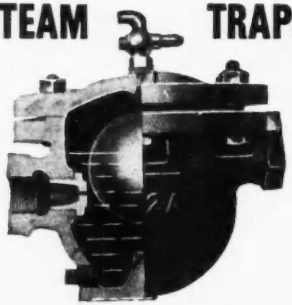

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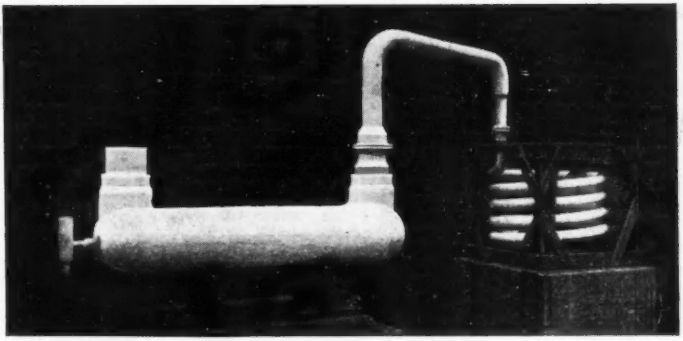

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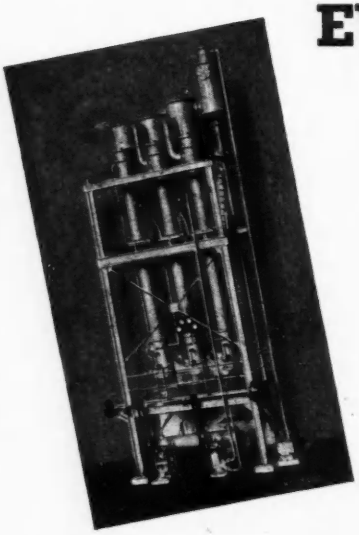

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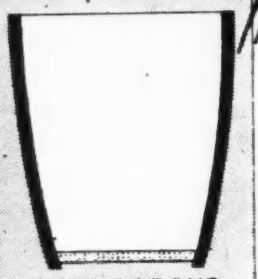

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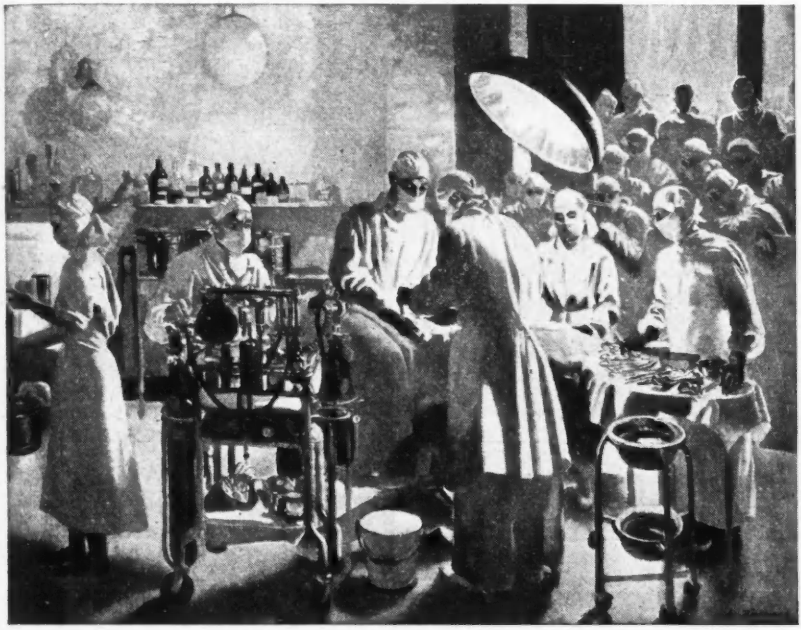

CONQUEST OF PAIN

IT may at first seem a far cry from the chemical factory to the hospital operating theatre. Here is a modern surgical operation in progress. The picture was painted in an operating theatre at St. Mary's Hospital, London. The chief interest in it must naturally centre in the figures of the surgeon and the patient, whose form is no more than suggested on the operating table. Yet it is appropriate that the anæsthetist with his trolley should occupy such a prominent place, for surgery as it is known to-day dates from the discovery of practical methods of anæsthesia. The power to produce insensibility to pain has enabled the surgeon to achieve his miracles. Less than 100 years ago surgery was a dire last resort and a brutal business, the patient having either to be tied down or drugged with quantities of alcohol. In 1846 ether was first used as a surgical anæsthetic by Dr. Warren in the U.S.A. In the following year chloroform was used in Edinburgh by Dr. (later, Sir James) Simpson, who was denounced from the pulpit for interfering with the works of God! To-day anæsthesia is a highly specialised branch of medicine, employing a large and constantly increasing number of chemicals. Of these some are inhaled through a mask, some are injected into a vein, and some are infiltrated into the tissues. Some give complete anæsthesia, others varying degrees of local anæsthesia only. Ether and chloroform are still used, but modern chemical research has made available special anæsthetics for all classes of purpose. Some anæsthetics are derived from the normal products of chemical factories. Ether is made from sulphuric acid and alcohol, and chloroform from bleaching powder and alcohol or acetone: cyclopropane and trichlorethylene are also relatively simple substances and are easily made, though skill and experience are necessary to produce all these in a high state of purity. Other anæsthetics, such as those of the barbituric acid group, are far more complex and their manufacture is only made possible by the skill, resource and research of the British organic chemist. In the field of anæsthetics, British chemical factories and research laboratories stand together behind the faculty of medicine to make available better and safer chemicals for the conquest of pain.

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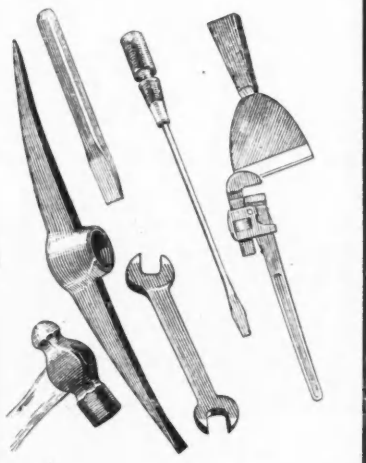

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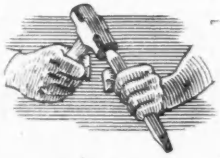

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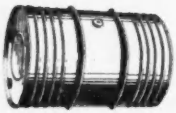

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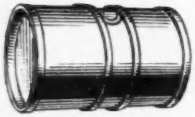

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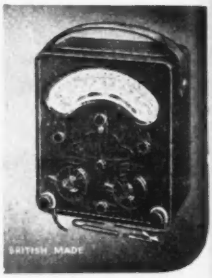

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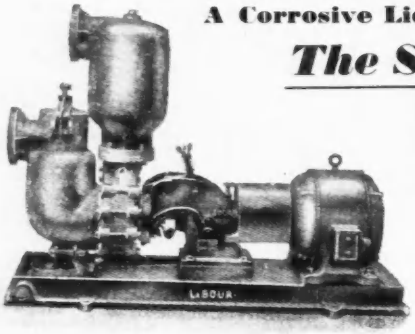

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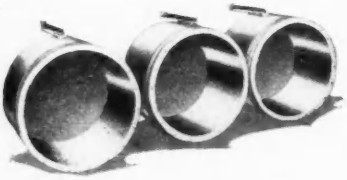

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Chemical Engineering in the Laundry

CHEMICAL engineering, like the poor, is always with us. A comparatively young child, as chemistry goes, it has proved remarkably precocious. There seems to be hardly any industry in which a knowledge of chemistry and of chemical processes applied to engineering will not produce remarkable transformations. It must have seemed strange to many to read the title "Chemical Engineering in the Laundry Industry," but this was an address given by Mr. F. Courtenay Harwood to the Institution of Chemical Engineers recently, and in that address Mr. Harwood showed that not only was the title no joke, but that chemical engineering has been applied to almost every phase of laundry operation, with the result that between a modern laundry and the domestic washtub, as many of us knew it in our youth, there is nothing in common other than the use of soap and hot water.

The laundry industry utilises three major raw materials, (*a*) softened water, (*b*) steam, and (*c*) detergents, such as soap and alkalis. The first chemical process is, therefore, that of water-softening. The lime-soda process is usually employed because, with the ordinary base-exchange type of softener, the bicarbonate alkalinity of the softened water is often sufficiently high to cause trouble during drying and finishing, giving rise to yellow stains on the garments. These stains can be removed by rinsing in hard water, but to do this holds up production. It is found that zeolite-softened water hardened up to 2-4 degrees by by-passing a certain amount of hard water into the feed-water tank is suitable for laundry boilers. Water of zero hardness when stored at an elevated temperature in large tanks, as it has to be for laundry work, is found to give rise to severe corrosion which has proved exceedingly difficult to overcome. The British Launderers' Research Association has investigated many types of protective coating and finds that, while a chlorinated rubber paint is reasonably satisfactory, for complete satisfaction the tank must be lined with vulcanised rubber or similar material. Steam is usually generated in shell boilers at pressures of 60-100 lb./sq. in. and rarely above 120 lb./sq. in. It is a little difficult to understand why economisers are not used in the laundry industry, also why steam is not superheated in order to prevent condensation in the mains. The fluctuating demand

On Other Pages

Notes and Comments	75
Fuel Economy in Boiler Operation	77
Personal Notes	82
New Control Orders	82
Wolfram Supplies	83
Recent Indian Research	84
Phenol Recovery Process ...	85
Chemical Bread Improvers ...	87
Tar Distillers' Activities ...	87
Synthetic Rubber Committee ...	87
Metallic Stearates	88
General News from Week to Week	91
Commercial Intelligence	92
Company News	92
Stocks and Shares	92
Deputation of Scientists	93
British Chemical Prices	94

for steam results in fairly considerable losses, and the laundry industry appears to be behind the times in that it has not made use of steam accumulators. That is a development to which we can look forward after the war.

The principal detergents used are soap, sodium carbonate, "modified" alkali, and sodium metasilicate. Other compounds which have found a use in laundering processes include sodium hypochlorite for the removal of stains, sulphated and sulphonated products as wetting agents, sodium hexametaphosphate for the dispersal of insoluble soaps, and sodium acid phosphate for adjusting the *p*H of the detergent solution. The Research Association has for several years been endeavouring to find a really good soapless washing process, and while some of the sulphated fatty alcohols and other similar long-chain compounds can be used fairly successfully in the low-temperature washing of lightly soiled goods made of wool, silk, or artificial silk, they are not satisfactory for the high-temperature washing of white cotton goods, even when used with sodium metasilicate, which in solution possesses a very marked suspending power. In the cleaning of soiled fabrics four main processes can be distinguished. (1) Efficient penetration or wetting-out of the fabric in order to establish intimate contact between the soiling and the detergent solution. (2) Displacement of the dirt from the fibres by the detergent liquor. (3) Suspension of the removed dirt in a finely-divided and stable condition. (4) Removal of dirty liquor, without the re-deposition of the suspended dirt on to the fabric.

The addition of soda ash to the water in the older washing processes had for its object the removal of loose dirt and the neutralisation of any acid that might be present. Research indicated that far more rapid and effective results could be obtained by cutting out this "breakdown" altogether and immersing the goods in a solution of soap contained in the washing machine. A study of the interfacial tensions assisted in this development. Most soiling matter on clothes behaves as though it had a thin film of grease round it, and consequently immersion in plain water does not effectively wet the surface, whereas immersion of the dry fabric in a soap solution results in almost instantaneous wetting. The removal, emulsification, and suspension of the soiling material is effected by adding acid sodium phosphate in controlled quantities to reduce the *p*H of the solution to between 7.5 and 8. In this way an acid soap is formed, which is surface-active towards grease, and consequently we may say that intimate mixing takes place. A known quantity of sodium metasilicate in solution is then added, which resaponifies the acid soap *in situ*, and the dirt particles, now easily detached from the fabric by the mechanical motion of the washing machine, become emulsified by the regenerated soap solution. The use of sodium metasilicate as the alkaline material not only produces the required *p*H in the solution, but does not reduce the suspending power of the soap solution itself. The emulsified soiling matter is, therefore, held in suspension and discharged from the washing machine.

The effect of this work has been that it has become possible to cleanse a load of soiled goods safely and effectively with considerable economy in water, a 30 per cent. saving in time and, consequently, a corresponding saving in power consumed, and some 40 per cent. saving in the quantities of soap normally required. In concrete terms, 100 lb. of soiled cotton or linen goods can be properly washed and given four rinses in the space of 45 minutes, with a consumption of only 10 oz. of soap and 1 lb. of sodium metasilicate. To carry out these physico-chemical reactions requires the design of washing machines, in which chemical engineering plays a considerable part, and the process has been standardised by the adoption of automatic control apparatus. After the goods have been washed and rinsed in the washing machine they are transferred to hydro-extractors in which the moisture content is reduced to about 50 per cent. The goods leaving the hydro-extractor are generally in a suitable condition for finishing and, after ironing, an operation which is now done semi-mechanically, the goods are taken to a drying plant in which they are treated with hot air circulated by a fan during their passage through the dryer.

Mr. Harwood gave an impressive

description of the chemical engineering of a laundry, but it left us open to wonder why it is that the quality of the work turned out by laundries still varies rather considerably. He spoke of the laundry engineer, but we heard no mention of the laundry chemist. Can it be that in applying chemical engineering the laundry industry has laid too much stress on the engineer and has forgotten the chemist as an essential part of the control staff?

NOTES AND COMMENTS

The Obligations of the Scientist

QUESTIONS of scientific ethics and the duties of men of science bulk daily larger both in "the literature" and in practice. Last week an important deputation, which included both scientists and politicians, approached the Government with the demand that a permanent Board should be set up to ensure correct co-ordination of scientific and technical matters of import to the State. Correspondence in the more serious Press has been urging such a step for some time past, and it now really looks as though something concrete were going to come out of it all. Meanwhile, another aspect of the question of the relation between the man of science and the layman has been raised in the correspondence and editorial columns of *Endeavour*. It is here particularly stressed that scientists should make themselves better understood by the man in the street. While pointing out that the average scientific worker is not especially articulate, it is contended that the cause of this is not so much the simple lack of a knowledge of the English language (as Sir John Russell hinted in his recent address to the Society of Chemical Industry), but rather "the exacting and engrossing nature of scientific research."

Self-Expression

FOR ourselves, we should be inclined to take a middle view; we can think of a number of scientists who have simply never bothered to attain an adequate degree of literary ability, not realising that this loss of the power of expressing themselves was a real loss, depriving their work of much of its usefulness, because it could never be "got across" to the ordinary citizen whom it was ultimately designed to benefit. On the other hand, some research workers are genuinely so deeply plunged into their work that they have no time to broadcast their findings, however skilful they may be with pen or voice. Happily, there is a third class, of whom the late Sir William Bragg was an outstanding example. These invaluable men are not only able to work at high pressure, but also to explain, to write, and to teach in a manner suited to all kinds of audiences, from the most ignorant upwards. Some of these, we are glad to note, have given us the benefit of their double skill in the pages of the third number of *Endeavour*, just published, and we hope that the class is not unrepresented in our own columns—but of that our readers must judge for themselves.

The Export of Chemical "News"

JUST now we would confine ourselves to calling attention to the mass of interesting scientific "news" in our contemporary, which is certainly one of the most valuable chemical exports of this country. It is still unhappily true (though less so every day) that the unthinking man still imagines that almost all chemical research of value has been done in Germany. One glance at *Endeavour* will dispel this notion. Professor Kendall, for example, reveals the existence of corporate chemical societies in Britain in the 1780's; Sir Robert Robinson details work done in this country on the anthoxanthins and anthocyanins which colour our flowers; Sir Edward Appleton describes the development of plastics manufacture; and Professor Garrod speaks of progress in chemotherapy, the fundamental work in which is due to France, Britain, and the U.S.A. In the last connection it is interesting to note that the Germans, so far from taking up a scientific attitude, have assumed a pose of "reverent agnosticism" as if the secrets of chemotherapy were such as we could not hope to master. Fortunately, others

were more robust, and Professor Garrod reveals their work and its amazing results.

London Dehydration Plant

DEHYDRATION is the new war weapon. The idea of drying foodstuffs for packing is not new, but the problems of shipping space have directed research to the task of improving methods and increasing the scale on which a much wider range of foods can be dealt with in this way. As we showed last week, 20,000 tons of dehydrated butter have been ordered by the British Government from New Zealand during this season and next. Experiments are being made in New Zealand, Australia, South America, and the United States with the dehydration of meat, and samples have already been eaten in catering establishments in this country—the customer very often not knowing that there was anything out of the ordinary about it. Now the process has taken an important step forward by the establishment in London of a large plant for drying and packing vegetables.

Carrots, Cabbages, Potatoes

DEVELOPMENT of methods of drying other foods is going on in this country, but, in co-operation with the Ministry of Food, H. J. Heinz & Company, Ltd., are treating carrots, cabbages, and potatoes on a big scale. Eighty tons of potatoes alone are being dried and packed as nine tons of dehydrated vegetable every week at the new plant. The importance of dehydration by the process now being developed by the Government is that nothing of the nutritious value or attractiveness of appearance of the vegetables is lost after they have been soaked once more to return them to normal. Potatoes are first of all peeled with the aid of a machine lined with carborundum which ensures a good clean surface, and, after the eyes have been extracted by women workers, the tubers are cut into strips and boiled for a short time to inhibit the action of the enzymes—a precaution which helps preservation.

Forces First

TWO different processes of drying are being experimented with side by side in order to decide on the most efficient method. That speed of operation is secondary to the best means of preserving the good qualities of the food is shown by the constant testing of processes which take two or three hours and more than six hours respectively. In the quicker method, hot air is passed over trays of potato strips, while in the second process the vegetable travels on a moving belt with hot air blowing through it. Temperatures range from 65° C. to 88° C. The result is a crisp, flaked version of the strips of vegetable which can be packed in an eighth of the space that would have been required for the original potato. The tins used for packing are pumped free of air which is replaced by nitrogen to make the food keep better. The Services are to have dehydrated goods first, and already tins have been flown to Malta and Iceland.

U.S. War-Time Publicity

"SERIOUS depression after the war may be averted by a cushion growing out of research and product improvement, preceded and accompanied by adequate preparation through advertising." This sentence, written by C. H. Hazard, President of the Hazard Advertising Corporation, in a recent issue of *Chemical Industries*, reveals that the traders of the U.S.A. are also mindful of the need for keeping the names and qualities of their products in public view. Advertisement is, in fact, a form of education, and, as everyone knows who has served in the field of industrial science, a refresher course never does any harm: many of our memories are not what they were in our younger days, so why should we expect those of our customers to be any better? British traders who are not alive to this salient fact are very much in the minority, and "goodwill" advertising has been officially recognised as a sound policy; it is indeed good news to read that this sane advice is being given to their American colleagues also. Perhaps the first shock of war taxation may have led some of the weaker brethren to remove or reduce their advertising expenditure; but such wise words as Mr. Hazard's will soon bring home to them the realisation that this expenditure is part of a far-sighted policy. Companies aspiring to a high place in the post-war years will, he says, consolidate their position now and prepare for the future, with the rigorous competition that it will bring.

Fuel Economy in Boiler Operation

Improved Automatic Control

by D. D. HOWAT, B.Sc., Ph.D., A.I.C., A.Inst.M.M.

"The Government are satisfied that substantial economies in coal consumption can be obtained from industrial consumers without damage to war production . . . . through improved methods of fuel consumption." (White Paper on Coal, June 3, 1942.)

THE fluctuations in load to which every steam boiler plant is subject play a major part in determining the efficiency of the installation. Marine boilers in ships making long ocean voyages, or water-tube installations in base load power stations have to meet only small and foreseen changes in steam demand. Steam power plants supplying processing operations in chemical industries frequently experience very wide and quite unexpected swings in demand, which reduce the overall efficiency to a marked extent. Three factors, existing to-day in a degree quite unknown in normal times, make the question of boiler efficiency a matter of crucial importance not only to the boiler engineer, but to the man in charge of the processing operations and to the war effort generally:—

1. The diminished supply of suitable industrial fuels and the recurring threat of drastic rationing.
2. The need for utmost output from existing power plant for increased production emphasised by the difficulty of obtaining new plant.
3. The necessity for such operation of boilers as to ensure the maximum life of the component parts in order to minimise replacement costs and loss of time in repair.

Saving Steam

Steam, costing anywhere from 2s. to 3s. per lb. to the user, is an expensive commodity in any circumstances. Any saving in the amount of steam used or a reduction of even a fraction of one per cent. in the fuel consumed will contribute materially to a reduction in costs. This final consideration is one which demands unceasing attention not only in war-time, but under the strain of peace-time competitive business. Systems of automatic boiler control have taken an important place among the various methods advanced for increasing boiler efficiency and economy in steam utilisation. Several systems have been patented, but before outlining the outstanding features of four representative types the general principle of the method will be discussed.

At any given boiler rating, maximum efficiency will obtain only when the thermal input (represented by the air and fuel) is exactly balanced by the thermal output (steam flow) from the boiler. The index of this state of equilibrium is the steam pressure in the main header. A rising steam pressure indicates that the heat input is greater than the demand, while a falling pressure calls for an increase in the fuel supply to compensate increased thermal output. The demands for steam are beyond the control of the boiler operator, although he may and will use his intelligence and experience to initiate changes in fuel supply to meet expected or advised variations in demand. Until the introduction of systems of automatic boiler control the efficient operation of the plant was largely dependent upon the experience and skill of the boiler attendant. But even with well-designed systems of remote manual control there are obvious disadvantages in relying to such an extent on the skill and conscientiousness of an operator. A large number of automatic control systems have been installed and, although modifications and improvements are still desirable, the favourable results from these installations and the saving in fuel and maintenance costs appear to exceed those obtained with the best systems of remote manual control.

The Importance of Measurement

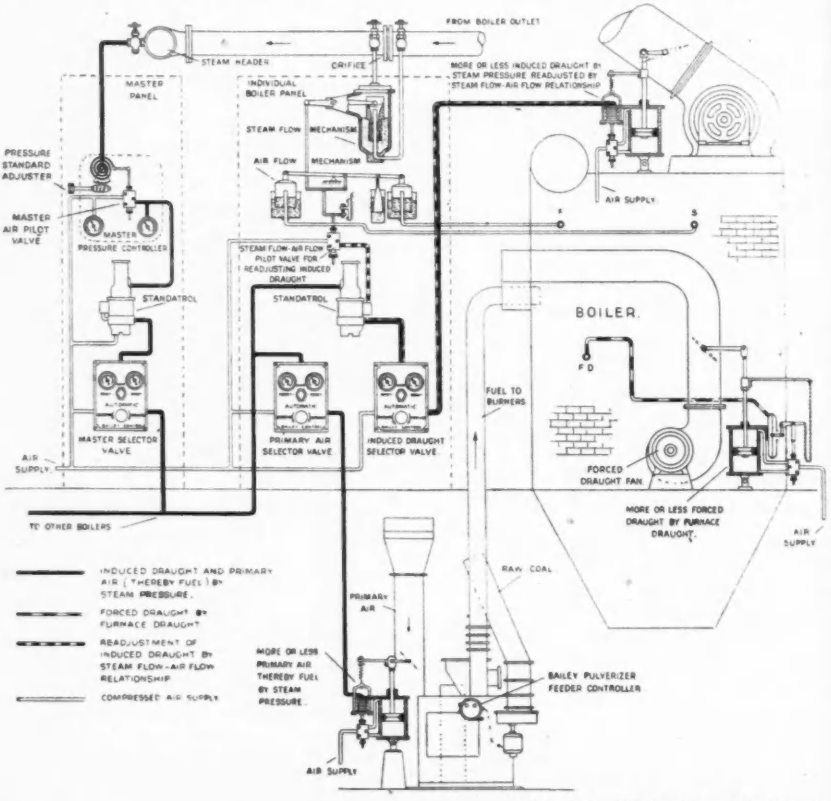
The function of automatic boiler control is to regulate fuel and air supply strictly in accordance with load demands. The quantities involved—steam pressure, fuel feed, and air flow—must be measured and means provided for regulating the supply of air and fuel to meet the fluctuations in steam demand.

Ideally, the variations in air and fuel supply should be arranged not only in accordance with the magnitude of the changes, but with the rate of change of steam demand.

The steam pressure in the main header, the index of the thermal input necessary, is the pivot of all systems of automatic boiler control. The measuring device (diaphragm, bellows diaphragm, or Bourdon tube) is incorporated in the master controller whose function is to translate variations in the steam pressure into equivalent pneumatic or hydraulic pressures for transmission to certain auxiliary fuel and air regulators. (Fig. 1.)

The regulators may be employed in a system of "positioning control" or one of "floating control." In the former, the position of the regulating means, such as a damper, may be altered by a simple "positioning device." The correction may easily be made proportional to the magnitude of the change in load and also to the rate of change. The advantage of this system of control is its ability to produce stable operation even in cases where there is a considerable lag between a variation in the supply of air and fuel and the responding changes through the boiler system. The disadvantages of "positioning control" are:—

1. The same standard is not maintained at all boiler ratings.



[*By courtesy of Bailey Meters & Controls, Ltd.*

Fig. 1.—Diagram of a Bailey meter control system applied to a pulverised-coal-fired boiler.

2. The correction is not made to the measured rates of air and fuel flow, but merely to the position of the regulating means.
3. The magnitude of the correction is arbitrarily determined and is in a fixed relation to the magnitude of the steam pressure change.

In a system of "floating control" a constant standard may be maintained at all ratings, but the control system is unstable and over-travel or "hunting" occurs.

A constant standard at all ratings is such a decided advantage that the balance is in favour of "floating control." The excessive tendency to "hunt" leads, however, to somewhat of a compromise between the two systems.

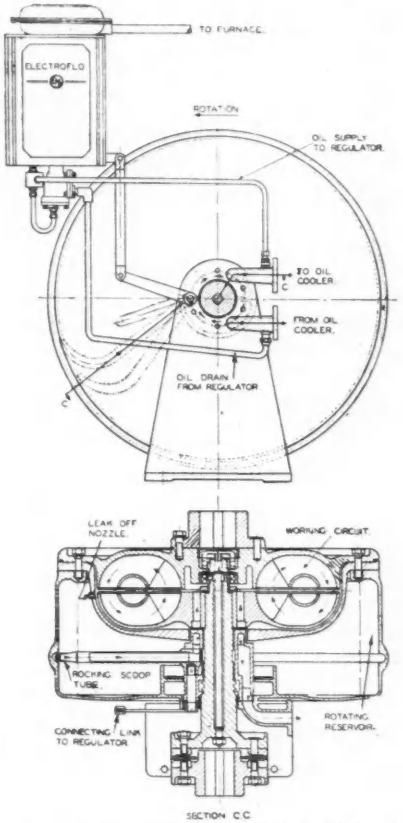
The ideal requirements of any accurate system of automatic boiler control may be summed up as follows:—

1. A constant standard (steam pressure efficiency, etc.) at all boiler ratings should be maintained.
2. Response to small variations in steam demand should be instantaneous and accurate.
3. Stability in operation, not subject to over-travel or "hunting," should be secured.
4. The quantities under control should be measured and corrections directly applied in accordance with the rate of change of demand.
5. The optimum (the most economical) fuel/air ratio should be maintained at all ratings.
6. The component mechanisms should be simple, robust, and durable

The degree to which any given system approaches the ideal is not easy to determine except after prolonged tests under the severest operating conditions. Advantages and disadvantages are associated with all the commercial systems, but a high standard of operational efficiency appears to be attained.

The modern water-tube boiler is a highly flexible plant with a low ratio of water to steam. Heat transfer from the gases to the water inside the tubes is rapid, the gas flow through the boiler being a measure of the amount of heat transferred. Two facts follow:—

1. The rate of steam generation is immediately dependent on the flow of hot gases through the boiler.
2. If the rate of flow is made to vary in direct proportion to the steam demand a steady supply of steam at the appropriate pressure and superheat will be made available.



[*By courtesy of Electroflo Meter Co., Ltd., and Hydraulic Coupling and Engineering Co., Ltd.*

Fig. 2.—Electroflo auxiliary regulator used in conjunction with a hydraulic coupling on a boiler fan. Note that with this type of coupling no power piston is required.

One of the main functions of all systems of automatic control is, therefore, to adjust the flow of gases through the furnace in accordance with steam demand. In its immediate results, accurate control of gas flow is more rapidly effective as a control measure than variation in the fuel supply. This is particularly true of stoker-fired fur-

naces where there is always a reservoir of fuel on the grate. Further, to a very large extent the gas flow through the furnace may be taken as a measure of the air supply. If the passes through the boiler are used as orifice plates, the drop in pressure across the tubes corresponds to the square of the gas flow. The following objections may be raised to the common procedure of equating gas flow and air supply.

(*a*) The volume of the gases will only be proportional to the air supply if the CO_2 content remains constant.

(*b*) Air-leakage may occur into the boiler with faulty settings or eroded brickwork.

(*c*) With the rapid drop in temperature the density of the gases will vary rapidly and unevenly during passage through the boiler.

Nevertheless, the value obtained is at least a first approximation to the magnitude of the air supply, while the procedure offers an easy method of measurement.

Induced Draught Control

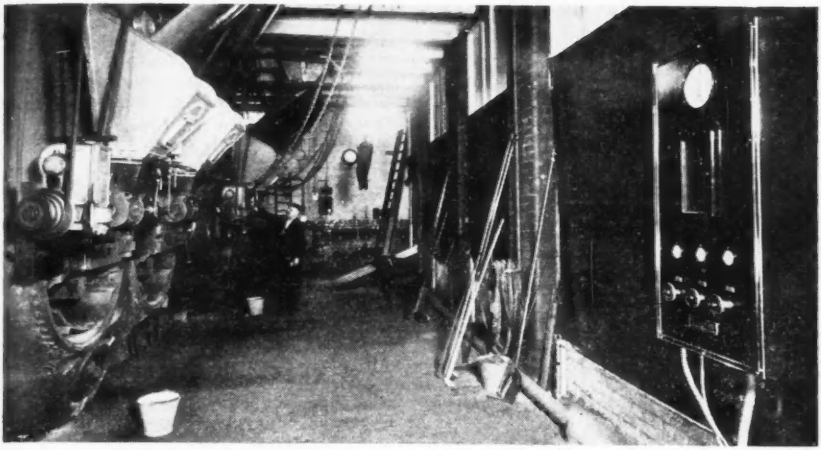
The first obvious point to position control of the gas flow, and incidentally of air supply, is on the induced draught. Like all auxiliary regulators, that used to control induced draught consists of a measuring device, an amplifying mechanism, and a power piston to operate the actual control gear. The hydraulic or pneumatic impulses from the master steam controller are balanced against the differential pressure across the boiler tubes, the resultant of the two forces being transmitted to the amplifying mechanism by means of a diaphragm or other suitable device. The power piston is operated by hydraulic or pneumatic pressure, the flow of pressure being controlled by the amplifying mechanism. Over-travel or "hunting" is prevented by some type of return motion linkage or overtaking gear fitted to the regulator.

The control of induced draught depends on the general mechanism or the type of fan fitted to the boiler. The simplest method is to alter the position of a damper in the exhaust duct, a simple linkage being effected between the power piston and the damper shaft. With modern equipment damper action may be reinforced or replaced by different types of fans and couplings. For example, the power piston may be made to vary the fan speed by shifting the brush gear in an A.C. commutator type of fan motor or by moving the rheostat in a D.C. motor. In a variable vane fan, the power piston may also alter the position of the vane ring. An almost infinite variation of speed may be obtained with the new types of hydraulic coupling (Sinclair type), the position of the scoop tube lever, which determines the speed, being altered and controlled by the power piston. In some cases sufficient power is provided by the amplifier alone to move the scoop tube lever through its entire range. (*See* Fig 2.) In many systems of automatic control the auxiliary regulator on the induced draught is only one receiving direct impulses from the master-steam controller.

Forced Draught Control

When a forced-draught fan is fitted, the pressure in the combustion chamber is dependent upon the balance of the forced and induced draughts. Further, where a forced-draught fan is fitted, the gas flow through the boiler is not determined only by the induced draught. Provision must be made for the control of the forced draught to protect the boiler walls and to reduce to a minimum the infiltration of cold air into the combustion chamber. The pressure in the combustion chamber is the balance between the forced and induced draughts, a level gauge value being commonly found at a point near the top of the combustion chamber. When these conditions obtain there should be a slight draught over the furnace, positive pressure not arising at any point. The pressure at the selected spot near the top of the chamber is applied to one side of a diaphragm and counterbalanced by an adjustable spring. Movement of the diaphragm is transmitted through the amplifying device to the power piston. Forced draught is controlled by the operation of the power piston through mechanisms of the same type as those described under induced draught.

Although control of the air-supply is



[By courtesy of George Kent, Ltd.

Fig. 3.—Battery of automatically controlled Lancashire boilers in a leather cloth factory. Note the control gear on the stoker motors.

more immediately effective in regulating steam supply, fuel feed must also be adjusted accordingly. Methods of control of induced and forced draughts are common to both stoker-fired and pulverised-fuel-fired boilers, but very different means of fuel control must be adopted in each case.

Another factor involved in the control of fuel supply is the maintenance of the correct fuel/air ratio under all operating conditions. A certain excess over the theoretical requirement of air is necessary in all cases. The amount of excess air required should be cut to the minimum, provided that:

(*a*) Excessive wear and deterioration of furnace brickwork and fittings is prevented.

(*b*) Unburned CO does not appear in the stack gases.

(*c*) Undue emission of smoke is obviated.

(*d*) Carbon is not found in the ash.

The total air expressed as a percentage of the theoretical may vary from 120, with modern water-cooled furnaces burning pulverised fuel, to 160 or more in combustion chambers with solid refractory walls. The optimum value may be obtained only after extensive tests on the actual boiler, but once determined the value should be maintained at all normal ratings.

In stoker-fired furnaces two methods of measurement and control may be mentioned. A small suction fan is direct-coupled to the end of the stoker shaft and an orifice plate is inserted in the induction pipe. The differential pressure across the orifice plate (proportional to the square of the air flow to the small fan) measures the square of the fuel feed and is balanced against the differential pressure across the boiler tubes (proportianal to the square of the air supply). The two forces are applied across a diaphragm, the movement of which operates through an amplifying device and power piston on the stoker-motor speed control. Where a fuel bed of constant depth is maintained on the stoker, the fuel feed is proportional to the stoker speed. This mechanism ensures (*a*) that the fuel supply is adjusted in accordance with the air supply, and (*b*) that the fuel/air ratio found most economical for the furnace is maintained at all boiler ratings.

(To be continued.)

Increased cultivation of rubber, quinine, Manila hemp, and palm-oil, which is reported to be planned in Central America, will help to offset the shortage of these products due to Japanese conquests in the Pacific. Experiments are to be carried out in Honduras with the cultivation of tung trees and castor-oil plants.

Personal Notes

SIR EDWARD CROWE, president of the Royal Society of Arts, has been re-elected chairman of the Society's council for the ensuing year.

The engagement is announced of MR. J. S. TOWERS, managing director of J. W. Towers and Co., Ltd., Widnes, and Miss B. H. Whinnerah, W.A.A.F., of Blundellsands.

THE HON. DEREK JOHN HENRY MOND, elder son of Lord Melchett, vice-chairman of Imperial Chemical Industries, Ltd., was married at Cheltenham on July 18 to Miss Yvonne Victoria Searle.

DR. H. B. NISBET, F.I.C., Lecturer in Chemistry at the Heriot-Watt College, Edinburgh, has been appointed by the Governors to the new post of Lecturer in Fuel Technology.

COMMANDER T. G. BEDWELL, who was six weeks ago appointed chief adviser on industrial publicity in the Ministry of Production, has resigned. Commander Bedwell is joint managing director of Bell's Asbestos and Engineering Co., Ltd.

MR. GORDON MACDONALD, recently appointed Regional Coal Controller for Lancs., Cheshire, and N. Wales, has tendered his resignation as Labour Member for Ince (Lancs.), having accepted the Stewardship of the Chiltern Hundreds.

Five more regional controllers have been appointed by the Minister of Fuel and Power as follows: SIR JOHN DALTON (London and South-Eastern), COL. W. H. WOODALL (Southern), MAJOR E. BADBURY (South-Western), and MR. H. H. HOLMES (Eastern).

MR. M. F. GOUDGE, of the Dominion Bureau of Mines, has been awarded the medal of the Professional Institute of the Civil Service of Canada for his discovery of valuable deposits of brucitic limestone, and for the development of an economic process to produce pure calcined magnesia for basic refractories and for making magnesium metal.

DR. K. J. LAIDLER, who for some time has been junior research chemist to the National Research Council of Canada, has been made scientific adviser to the Inspection Board of the United Kingdom and Canada in connection with artillery. Dr. Laidler gained first-class honours in chemistry at Trinity College, Oxford, and a Commonwealth Fellowship to Princeton University, U.S.A., in 1938.

MR. C. A. MASTERMAN has been appointed to the Directorate of Gas Supply and will co-ordinate the work of the Directorate in connection with the use of town gas for war purposes. In the last war Mr. Masterman undertook research for the War Office and was later appointed senior assistant in the Defensive Munitions Department at the experimental station at Porton. He joined The Gas Light and Coke Company in 1927, becoming chief technical officer at Watson House.

Obituary

MR. LACHLAN BROWN, who died at Dundee on July 17, aged 92, had for more than 30 years carried on business as a manufacturer of furniture polishes and oil blackings at King's Cross Chemical Works, Dundee.

MR. WILLIAM ARTHUR ALBRIGHT, the Birmingham chemical manufacturer, died at his Edgbaston home on July 13, aged 88. He was educated at Grove House School, Tottenham, and after three years' apprenticeship with a firm of ironmasters, joined the chemical manufacturing business in Birmingham, founded about 30 years previously by his father and Mr. Edmund Sturge, which later became the firm of Albright and Wilson. Mr. Albright retired from the firm in 1915, having been its chairman for 10 years.

We regret to record the death of MR. ERIC ARTHUR REAVELL, B.Sc., A.R.C.S., A.I.C., M.I.Chem.E., who died at Midhurst on July 15 after an illness of about 15 months. Mr. Reavell was a director of the Kestner Evaporator and Engineering Co., Ltd., and of the Lennox Foundry Co., Ltd. His activities were entirely connected with his scientific career; and he was devoted to the profession of chemical engineering, in which he had wide experience both at home, on the Continent, and in America. He was the possessor of a quick and active brain and his ability to master the essentials of technical problems presented to him was quite exceptional. He was educated at Bishops Stortford College, and attended the City and Guilds Engineering College before the last war. After a period of service with the R.N.A.S. he returned to the Royal College of Science, taking the B.Sc. degree in chemistry, and later, as his other degrees show, he took an active part in the institutions connected with his profession.

New Control Orders

Plenary Control of Fuel

Under the Control of Fuel Order, 1942, which came into force on July 20, specific directions will be issued by the Minister of Fuel and Power as to the supply and consumption of various types of fuel; and these directions can apply to any class of persons or premises. They can, among other things, specify the purposes for which, or

the circumstances in which, fuel is to be supplied or consumed; and they can prescribe periods during which it may or may not be supplied or consumed. Any existing statutory or other obligation which binds a public utility undertaking is relaxed, under the provisions of this Order, to whatever extent may be necessary to enable the undertaking to comply with the terms of a direction. Another provision in the Order gives to police or other authorities the power to enter and inspect premises for the purpose of securing compliance with the Order.

The fuel covered by the Order includes coal and coke, paraffin oil, various liquid fuels (which are described in the Order), such as gas and diesel oil, fuel oil, tar, pitch, creosote, etc., and also wood fuel.

Exports to South Africa

The Board of Trade has made an Order which will come into force on August 3, and will have the effect of making exports of all goods to South Africa and Southern Rhodesia subject to export licence. Under another Order which comes into effect on the same date, all export licences for those destinations (other than licences issued to the respective High Commissioners, and to certain semi-official bodies) issued before July 3 will be revoked. The object of these Orders, which have been made after consultation with the Union and Southern Rhodesian authorities, is to restrict the export trade with these countries in order to bring it more closely into line with the limited shipping space available for commercial cargoes under present conditions.

Packing Control

By the Control of Packaging (No. 1) Order (S. R. and O. 1942, No. 1366), which came into force on July 23, the Ministry of Supply controls the packaging by manufacturers of a wide range of commodities. The packing materials concerned include paper, glass, metal, fibres, and plastics, and most commodities in general use are affected. The aim of the Order is to save materials, labour, plant and transport, and to prevent the indiscriminate substitution of certain types of container for those that are already controlled.

Restrictions are imposed on the printing and decoration on all the containers now to be controlled, with the result that two colours will normally be the maximum allowed. The number of different sizes of container in which any one commodity may be packed is also limited, and in some cases only a single size is allowed. Containers in existence on July 23 may be used, provided that they are of a type which was generally in common use earlier than 1941 for the purpose for which it is now employed.

Reference is made to the B.S.I. Schedule of Containers, No. 1048/1942, which may be obtained from the British Standards Institution; the Order is obtainable (price 2d. post free) from H.M. Stationery Office, or through booksellers.

Wolfram Supplies

Official Scheme to Purchase Concentrates

TO encourage the production of wolfram by individuals and small groups of workers, the Ministry of Supply is prepared to arrange to purchase small quantities of rough concentrates of an assay value down to 10 per cent. WO_3, on the basis of a price of 100s. per unit of WO_3 as 65 per cent. clean concentrates, less the charges set out below, and less an allowance for low-grade material. Arrangements have been made for the concentrates to be purchased by Non-Ferrous Minerals Development, Ltd., on behalf of the Ministry of Supply, who are sole authorised buyers. Parcels of concentrates should be sent carriage paid to Plympton (G.W.R.) Station, addressed to Non-Ferrous Minerals Development, Ltd., Plympton, Plymouth, who should be advised by letter.

Parcels will be weighed, crushed, and sampled and the producer can be present, or represented, if he wishes. Assays will be made on behalf of the Ministry, and while they must be accepted as final, every care will be taken to ensure that the appropriate value is placed on the parcels.

Charges and payments will be as follows:

(1) For collection, weighing, sampling, and dressing a charge at the rate of 1s. per cwt. of rough concentrates will be made, with a minimum of 5s. for small parcels under ¼-ton in weight.

(2) There will be a uniform charge of 15s. per parcel for assaying.

(3) Magnetic separation will be charged at the rate of 1s. per unit of tin metal and per unit of WO_3 paid for.

(4) Payments will be made on the basis of recoverable tin metal and WO_3. In the case of simple ores, if the rough concentrates contain less than 20 per cent. of tin plus WO_3, 90 per cent. of values will be paid for, with a rising scale of payments up to 100 per cent. when the rough concentrates contain above 65 per cent. of tin plus WO_3. Any complex ores and concentrates offered will be accepted only after recovery tests have been made.

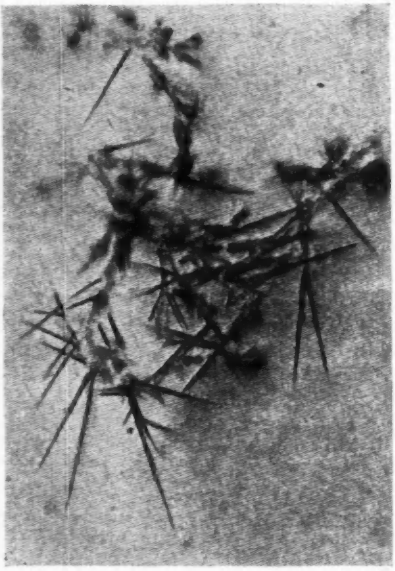
(5) Tin metal will be paid for at a price per unit of 22.4 lb. based on current metal prices; WO_3 will be paid for at 100s. per unit of 22.4 lb.; both less 1s. per unit for the cost of magnetic separation.

(6) Settlement will be made as to 75 per cent. on estimated value of parcels when received, balance after receipt of assays.

Recent Indian Research

Shellac Moulding Powders

TWO interesting papers have recently been issued by the London Shellac Research Bureau, both reprinted from Indian journals of science. In the first paper, Y. Sankaranarayanananan and H. K. Sen discuss the properties of Shellac in Injection Moulding (*J. Inst. Chem. Ind.*, 1941, *13*, 4, p. 145), an important matter in Indian economics to-day, now that imported moulding powders are hard to procure. Shellac, as is well known, is a native product, nearly 90 per cent. of the world's output being derived from India; but pure shellac is practically useless for moulding, as it is extremely brittle, and very soft even at moderate temperatures. The authors have examined the methods of overcoming these disadvantages. Brittleness, they have found, is readily overcome by using a filler, and waste jute (also a native product), with kaolin or barytes, was proved to be the most satisfactory. The jute is first passed through a disintegrator with a 12 to 18 mesh sieve.



Sodium stearate crystals (× 100)

To raise the working temperature from 85°-90° C. it was found essential to employ accelerators, and alkaline agents, such as guanidine carbonate (5 per cent.), guanyl urea (5 per cent.) or ammonia (0.888 aqueous solution; 3 per cent.) appeared suitable. With the above treatment shellac moulding powders work smoothly up to a temperature of 150°-155° C., though not beyond. The best composition made so far may therefore be described as follows: shellac (30 mesh), 300 parts; jute (12-18 mesh), 200 parts; kaolin, 100 parts, or barytes, 300 parts; pigment, 15 parts; calcium stearate, 9 parts.

The ingredients are mixed together and then well kneaded with an aqueous solution of ammonia (9 parts of 0.888 in 500 of water). The powder is allowed to dry in the air. It is then run through steam-heated hot rollers, when it will be thoroughly mixed and obtained in the form of thin sheets. These are allowed to cool, crushed coarse (5-10 mesh), and cured in a shelf drying oven at 85°-90° C. for 1½ hours. The powder is then ready for use and may be fed into the hopper of the injection moulding press. It flows uniformly and well at 135°-150° C., using a pressure of 30 atm., and may thus be used for continuous moulding for any length of time with efficient water-cooled moulds. The articles are glossy and sufficiently strong, with an impact strength of 4.2 to 4.4 kg./cm./cm², and the material may be sprayed with a weather-resisting varnish or lacquer if extreme weather resistance is desired.

Soap Crystals

In the second paper, S. R. Palit (*Current Science*, 1942, *11*, 1, p. 13) records the successful preparation, by a convenient method, of crystals of alkali metal salts of long-chain fatty acids. The chief difficulty in this case has hitherto been the preparation of a good solvent; this the author has surmounted by discovering suitable mixtures of organic solvents (not specified) which have a powerful solvent action on soap at room temperature. Excellent microphotographs of sodium stearate and potassium stearate crystals are reproduced; the corresponding palmitate crystals have also been photographed. The sodium stearate crystals are illustrated herewith.

The Ministry of Food announces that, with the object of augmenting supplies of malt vinegar, the Minister has sanctioned the use of added sugar in the brewing process. This is purely a war-time measure, and the essential character of the vinegar produced will not be changed. The use of sugar is restricted to the quantity necessary to produce a 15 per cent. increase in the volume of vinegar brewed.

Phenol Recovery Process

Double Output Obtainable

IF all the phenol in the low-temperature liquors produced from brown coal in Germany could be recovered, it would amount to about 30,000 tons a year. Liquors from the brown-coal hydrogenation plants probably contain as much again. The two together, if completely exploited, would yield considerably more than the present European phenol output from all sources.

Until recently, only two processes have been really successfully used for the recovery of phenol from the low-temperature carbonisation liquors of brown coal: the Koppers process, first developed in the U.S.A.[1] improved in Germany and now in use at a very large low-temperature carbonisation plant at Böhlen in Saxony,[2] and a wash-oil process in use at another very large plant at Deutzen known as Kraft II.[3] The other processes which have been successfully used for phenol recovery in Germany from various liquors have not been found fully applicable to the liquors from low-temperature carbonisation; the benzol process, which is used at coke ovens, on account of the high losses of benzol that would result; the active carbon process, which is also used for liquors from hard coal, because the high-molecular-weight constituents of low-temperature carbonisation liquors were found to polymerise on the active carbon and cause a very high rate of consumption; and the Triphos process, which works extremely well with the liquors of gasification of brown coal, because the tricresyl phosphate was unexpectedly found to retain a proportion of the phenol in low-temperature carbonisation liquors and also to become gradually poisoned by gums and resins.[4] The Lurgi-Gesellschaft für Wärmetechnik, whose process for the low-temperature carbonisation of brown coal has gradually become preferred for most new plants in Germany, not unnaturally wished to have a phenol recovery process to use in conjunction with its carbonisation process—for reasons of prestige if not from purely pecuniary motives. To this end, the company started investigations in 1937 and set out to search for a solvent which would as far as possible be indifferent to the composition of the liquors to be dephenolised. It was found that by far the best solvent in every respect was a mixture of esters of various higher alcohols, which was eventually called Phenosolvan. The specific gravity of this mixture is 0.88 and its boiling range 110°-130° C. Some idea of its solvent efficiency is given by the following figures for the amount of various dephenolising media needed to reduce the phenol content of a low-temperature carbonisation liquor from 7 grams per litre to 0.1 grams per litre:

	% by volume of liquor
Benzol	220
Dephenolised low-temperature oil	250
Triphos	17.5
Phenolsolvan	10

In 1940, after it had become known to the Lurgi company that the I.G. Farbenindustrie, recognising the limitations of its Triphos process, was also working on the same problem, the two researches were pooled and continued along the Lurgi lines. Small-scale operations were started in a pilot plant early in 1940, and the results were so successful that in the summer the construction was begun of a full scale unit

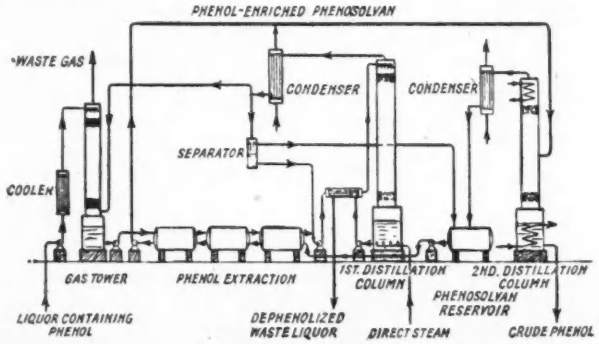


Fig. 1.

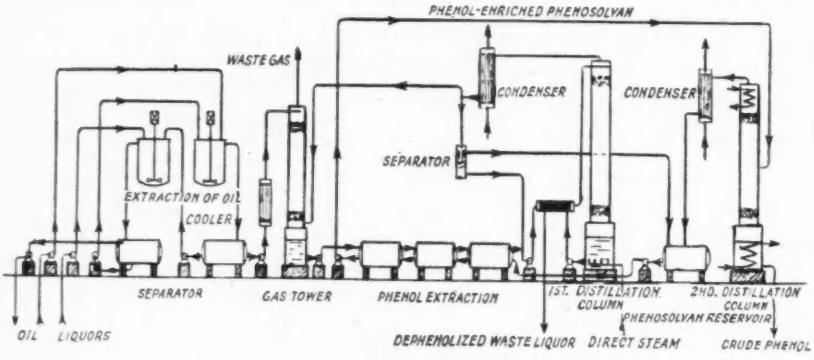


Fig. 2.

at a hydrogenation plant. This unit started work in October, 1941. Its design is shown in Fig. 1.[5]

Recovering Solvent Vapours

The hydrogenation or low-temperature liquors are pumped through a gas tower where the waste gases from the dephenolising plant itself are passed in counter-current to recover any solvent vapours which may be contained in them. The liquors are then treated in counterflow with 10 per cent. by volume of Phenosolvan in three vessels coupled in series. The liquors, freed of phenols but now containing about 0.7 per cent. by weight of dissolved Phenosolvan, pass through a heat exchanger and thence to a distillation column where the Phenosolvan, together with about 1 per cent. of liquor, is driven off by direct steam evaporation. The solvent and the liquor come down in a condenser, from where they flow to a separating vessel; here they separate by gravity. The Phenosolvan, which forms the upper layer, flows back to its reservoir, and the liquor from the lower layer returns to the cycle. The main bulk of the dephenolised liquor leaves the distillation column at the bottom and flows via the previously mentioned heat exchanger to waste. The solution of phenol in Phenosolvan coming from the counter-current extraction flows to a third distillation column where the two separate; the solvent flows to the reservoir and the phenol passes out at the bottom of the column.

Result of Testing

The results of 1½ years' testing of the pilot plant, using liquors from a large number of hydrogenation and low-temperature carbonisation plants, and the subsequent operation during six months of the full scale unit, have shown that the Phenosolvan process appears to be fully capable of application to any liquors that contain phenol. It has none of the idiosyncrasies of the active carbon and Triphos processes, and it is not expensive to run, as is the benzol process. As regards operating costs, in fact, even the simple process outlined above more than pays its way. To increase the phenol yield, thereby making the process cover not only operating costs but also capital charges, it has been found possible to dephenolise not only the liquors, but also a part of the liquid products of both hydrogenation and low-temperature carbonisation, as is also done with the Koppers process at Böhlen. This is effected by taking a cut of the middle oil, of boiling range, say, 150°-210° C., and mixing it with the liquors after the latter have been heated to 70°-90° C. The bulk of the carbolic acid and a good part of the cresols in the oil then dissolve in the liquor; in this way the content of phenol in the liquors can be increased by from 70 to 200 per cent., depending on the coal under treatment, and phenol output is correspondingly raised at a trifling cost. Several test plants are in operation using this process; an example of one is shown diagrammatically in Fig. 2. As stated above, the liquor is heated to 70°-90° C. and is then mixed in two stages with the oil fraction. The oil leaves the mixing plant and the phenol-enriched liquor passes to the Phenosolvan unit, the design of which is exactly as before. Several full-scale units of this type are now under construction, and it is stated that their output, when they are all completed, will exceed that of all the other plants in Germany which recover phenol from liquors. Presumably, the majority of these new units are at hydrogenation plants; their output, if the above statement is true, will considerably exceed 10,000 tons of phenol annually under normal conditions.

The efficiency of the process is about

97-98 per cent.—that is, it reduces the phenol content of liquors from, say, 7 per cent. to 0.1-0.2 per cent. In the type of plant which treats both liquors and an oil fraction, about 1800 lb. of steam are required for each 1000 gallons of liquor, while the consumption of power is roughly 14 kWh. and that of solvent 1.5-2.5 lb. per 1000 gallons. For a full-size plant the labour requirements are two men per shift. With a phenol content in the liquor of 4 grams per litre (about 0.4 per cent.), which is usually exceeded in low-temperature carbonisation liquors, the proceeds from sales of phenol more than cover operating costs and capital charges even when the latter are arranged so as to write off the plant in one or two years.

REFERENCES

1 *Gas J.*, 1929, *187*, pp. 407-9.

2 H. JUST, *Braunkohle*, 1941, *40*, pp. 245-9 and 259-63; *Gas World*, 1941, Coking Sect., Dec. 6, pp. 92-6.

3 F. ROSENDAHL, *Teer u. Bitumen*, 1941, *39*, pp. 57-8; *Gas World*, loc. cit.

4 *Coke and Smokeless Fuel Age*, Feb., 1942, pp. 40-2.

5 W. HERBERT, *Oel u. Kohle*, 1942, 38, pp. 525-31.

Chemical Bread Improvers

A Study of their Mechanism

BASING their experiments on the generally-held belief that the flour proteinases belong to the papain group, J. Davidson and J. A. Le Clerc, of the Bureau of Agricultural Chemistry and Engineering, U.S. Department of Agriculture, have examined the effect of various concentrations of papain and potassium iodate on the loaf volume of bread (*J. Agr. Res.*, 1942, *64*, 3, pp. 145-52). The theory that an oxidising agent, such as potassium iodate, inhibits the enzymatic action of the proteinases, is confirmed.

Results of baking tests show that there is a consistent interaction between various concentrations of papain and potassium iodate in their effect on the loaf volume of bread. When added singly, some concentrations of potassium iodate and papain depress the loaf volume of bread, the extent of depression being greater the greater the concentration. When added together, certain of these concentrations counteract each other.

While papain stimulates diastatic activity and potassium iodate depresses it, the action of these substances on the loaf volume of bread cannot be ascribed to their effect on the diastatic power of the flour, since sodium chloride, which is always used in bread baking, also stimulates diastatic activity, yet causes no depression in loaf volume.

Tar Distillers' Activities

Development of Regional Planning

THE Association of Tar Distillers has been intensively concerned of late with the increasingly difficult labour situation, and a memorandum has been prepared, based on the experience of a number of tar distillers, on the employment of women in the tar distillation industry. The memorandum has already been approved by the various Government Departments and the Unions concerned, and will be circulated throughout the industry shortly. The transport problem also has been given most careful consideration on a regional basis, and close co-operation is being ensured in the use of rail tanks and other forms of transport of tar products. A survey with special reference to the most economic use of the rail tank transport available to the industry has just been completed.

Rapid progress is being made by the Association, in co-operation with the B.S.I., in the preparation of war emergency specifications for a wide range of tar products to replace imported bitumen. Other such specifications for tar paints and for a range of pitches for mastics are well in hand.

Addressing a recent meeting of tar distillers at Manchester, the president (Mr. C. E. Carey) emphasised the manner in which the industry lends itself to the development of strong regional organisations, particularly for the consideration of the present and future problems connected with the planning and development of the industry on a national basis—to which end such regional co-operation is an almost essential preliminary step.

SYNTHETIC RUBBER COMMITTEE

The following have been appointed members of the Synthetic Rubber Committee, according to a statement made by Sir Andrew Duncan, in the House of Commons on Wednesday: MR. F. W. BAIN, Chairman of the Chemical Control Board of the Ministry of Supply (Chairman); SIR EDWARD V. APPLETON, K.C.B., D.Sc., LL.D., F.R.S., of the D.S.I.R.; DR. J. W. ARMIT, B.Sc., Ph.D., Director-General of Explosives at the Ministry of Supply; SIR ROBERT ROBINSON, D.Sc., LL.D., F.R.S., Waynflete Professor of Chemistry at Oxford; and DR. F. ROFFEY, B.Sc., Ph.D., A.I.C., Controller of Chemical Research at the Ministry of Supply.

Chemical works in occupied Belgium continue to suffer heavily from their connection with the Nazis. On Wednesday last Boston bombers attacked another chemical works near Ghent in daylight.

Metallic Stearates*

A Review of Their Properties and Uses

INDUSTRIAL use of the water-insoluble stearates, such as those of calcium, aluminium, magnesium, and zinc, has become widespread during the past twenty years. Their versatile nature and the ever-increasing demand for them seem to indicate continued expansion in their applications.

The development of fatty-acid separation by distillation and other means may make it possible to produce a very pure stearic acid at a low price in the future. At the present time, triple - pressed stearic acid, containing approximately 95 per cent. stearic, is one of the raw materials used. Hydrogenated fish oils and other products of hydrogenation, containing a high percentage of stearic acid and small quantities of similar acids, are often employed. It has been found that the properties of metallic stearates are affected by the source and quality of the raw materials from which they are made. For this reason, uniformity and proper specifications for the raw material are of primary importance. In general, a stearic acid having a melting point of at least 56° C., a saponification number of about 200, and an iodine value of less than 5, is satisfactory. The presence of unsaturated fatty acids tends to produce rancidity in the finished goods, and the iodine value must therefore be kept at a minimum.

Aluminium Stearate

Aluminium stearate is, commercially speaking, the most important of the stearates manufactured by saponification of the fatty acid and subsequent precipitation by means of a soluble salt of the metal. Its use in industry has often been misunderstood for several reasons. By changes in the process of manufacturing it is possible to make an aluminium stearate of almost any desired acid-to-base ratio. As a result, many varieties have been marketed under various trade names and numbers, each possessing different chemical and physical properties. Theoretically it is possible to produce three aluminium stearates, owing to the trivalency of aluminium metal. The mono-acid stearate $Al(C_{17}H_{35}COO)(OH)_2$, the di-acid stearate $Al(C_{17}H_{35}COO)_2OH$, and the tri-acid stearate $Al(C_{17}H_{35}COO)_3$, represent the three combinations. The manufacture of these definite compounds would obviate all misunderstanding and enable the user to obtain a product of any desired acid/base ratio.

Commercial products closely approximating the three theoretical compounds became available several years ago, but owing to the procedures used in manufacturing technical stearates, all grades contain some free fatty acid. In the case of the tri-acid stearate the percentage lies between 23 and 28. McBain and McLatchie were unable to prepare pure tri-acid aluminium soaps by precipitation from soap solutions. In fact, the existence of tri-acid aluminium stearate is doubtful. Nevertheless, the technical product, the analysis of which in terms of aluminium oxide and total fatty acid corresponds to a tri-acid stearate, has definite properties and is of value to industry. In addition to the acid/base ratio and the free fatty-acid content, physical differences such as bulk and texture play a part in determining the properties of an aluminium stearate. Consequently, careful standardisation of manufacturing procedures and chemical control throughout are essential.

All the aluminium stearates are white or almost white fine powders. The tri-acid grade usually has the greatest bulk in fluid ounces per pound, and the di-acid the lowest. This property, however, may be varied by changes in the process of manufacturing.

Available Solvents

The use of an aluminium stearate depends on its insolubility in water and its solubility or gel-forming properties in various solvents. In general, hydrocarbons such as benzol, toluol and xylol are good solvents, giving clear solutions or viscous gels according to the concentration, method of preparation, and the grade of aluminium stearate employed. Compounds containing chlorine, such as ethylene chloride, trichlorethylene, carbon tetrachloride and chloroform, as well as turpentine and petroleum solvents, are also effective. Nearly all mineral and vegetable oils exert solvent action. On the other hand, the aluminium stearates are not soluble in alcohols, esters, and ketones of low molecular weight such as methyl alcohol, ethyl alcohol, ethyl acetate and acetone. *N*-amyl and *n*-butyl alcohols have some solvent power, while butyl acetate and amyl propionate are said to form pastes. Aluminium stearate forms a gel in hexane, heptane and decane, but not in pentane, aniline, pyridine, cresol, *o*-toluidine or benzyl benzoate.

The mono-stearate forms the stiffest gels and the tri-stearate the thinnest. The di-stearate is intermediate between the two. Increasing the temperature of solution increases the solubility of a given stearate, so that a more concentrated solution can be made, which in turn raises the viscosity of the resulting gel. For example, if 5 gm. of the di-acid grade are heated with 100 gm. of toluol, the stearate dissolves gradually and the viscosity increases slowly. When a temperature of about 54° C. is reached, gel formation begins and the viscosity increases very rapidly as heating is continued. At about 70° C. the viscosity reaches a maximum. Further heating tends to lower the viscosity. On cooling, a clear, elastic gel results. If

* From an article by Adolph Monsaroff, A.C.I.C., Mallinckrodt Chemical Works, Ltd., of Canada, in *Can. Chem. & Proc. Ind.* 1942, **26**, 4, p. 192.

10 gm. of aluminium stearate were dissolved instead of 5 gm., the incipient gel temperature and the range over which gel formation occurred would be the same, but the final cooled gel would be more viscous.

There seems to be an optimum temperature range for each solvent during which the viscosity increases rapidly and gel formation occurs. With trichlorethylene, for example, the range is between 47° C. and 58° C., when a 5 per cent solution of the di-acid stearate is used. The chlorinated solvents and the hydrocarbons give stiff, elastic gels, and retain these characteristics. In the case of pyridine, the di-acid stearate dissolves at 70°-80° C. to form a clear solution, but on cooling the stearate separates and a true gel is not obtained at any time. Another point to remember in working with dispersions of this type is the rate of cooling. Rapid cooling results in more viscous gels than slow cooling.

Aluminium stearate is employed not only in the paint and varnish field and in grease manufacture, but also as follows :—

(1) As a waterproofing agent in cements, concrete, insulating wrappings, ropes, leather and canvas ; (2) as a water-repellent on wood ; (3) as an anti-oxidant in transformer oil ; (4) as a suspension agent in disinfectants and insecticides, as with Paris Green in mosquito control ; (5) as an ingredient in floor waxes, polishing compounds and dry-cleaning preparations ; (6) in the manufacture of dyes and dye preparations ; (7) in tinning and soldering compounds ; and (8) for artificial thickening of vegetable and mineral oils. It has also been mentioned as an astringent in cosmetic preparations, and as a rust preventive.

Stearates in the Paint Industry

The three grades of aluminium stearate are widely used in the paint and varnish industry, and the specific properties of each grade serve a definite purpose. A combination of effects may be obtained by the use of two or three grades in various proportions. The mono-stearate is best where the proportion of pigment to vehicle is high, as in the case of flat paints. In flat varnishes, small quantities of it give the desired results with much less tendency to gel. It may also be employed to increase the base content. The di-stearate is preferable for modifying body, flatting, and as a suspension agent in most paints. The tri-acid grade is especially valuable as a flatting agent in varnish manufacture, where the proportion of pigment to vehicle is low. It forms weaker gels than the di-stearate and can be dispersed more easily and in greater concentration in most organic solvents.

Several methods of incorporating aluminium stearate into a paint or varnish are employed. As a suspension medium, one or two per cent. by weight of the stearate is added directly to the other pigments in the paint mill. Alternatively, the stearate may be dissolved in a solvent to form a paste, and then ground into the paint. Another method consists of making a thin dispersion in a solvent and wetting the pigments before grinding. Some manufacturers of flat varnishes prefer grinding the stearate in solvents, and then adding to the varnish. Others grind the stearate with the varnish in a pebble mill.

Metallic Soaps

In the development of modern lubricants the use of metallic soaps has received considerable attention. Soda and lime soap greases are made in larger quantities, but the popularity of aluminium stearate as a base in grease manufacture has increased rapidly in recent years. The stearic acid/aluminium oxide ratio, previously mentioned, is a basic factor in the behaviour of aluminium stearate in greases. The di-stearate dispersed in most mineral oils gives the stiffest gels. In some cases, however, the greases thus formed tend to crack and bleed. This condition may be corrected by increasing the acid/base ratio, *i.e.*, by adding tri-stearate. On the other hand, a di-stearate may form a soft grease with a particular oil. In this case the addition of a small amount of mono-stearate acts as a hardener.

The viscosity of the oil and the quantity of aluminium stearate are two other important factors affecting the consistency of a grease. With this knowledge in mind, the grease-maker can determine experimentally the best condition for manufacturing a grease of the desired specifications by varying the following : (*a*) type of oil ; (*b*) rate of cooling ; (*c*) moisture content ; and (*d*) time of compounding.

Once the best conditions have been determined, the method of manufacture is not difficult, but does demand close observation and proper temperature control. A common procedure is to add the aluminium stearate to the cold oil in a steam-jacketed kettle equipped with an efficient agitator, and then gradually raise the temperature to 110°-130° C. The appearance of the batch changes as heat is applied until a clear thick gel is formed. At this point more cold oil may be added slowly to avoid too great a drop in temperature. Heating and agitation are then resumed. The gel gradually disintegrates, dissolves in the oil, and forms a smooth grease. Cooling is effected very slowly in the kettle until a maximum consistency is reached which still permits the grease to flow. It is then run to the containers and allowed to attain room temperature slowly.

Calcium Stearate

Calcium stearate is a white, fine, slippery powder, usually available in three grades : the technical, pure, and impalpably powdered. Chemically, the three grades are identical ; but they differ in physical properties such as bulk and melting point. The technical and pure grades are made by the fusion method, and are therefore much denser than the impalpably powdered material, which is made by precipitation. Water - repellency is the outstanding characteristic of calcium stearate. It does not readily dissolve in solvents. As a waterproofing agent, it is used in the ceramics

industry for treating cement, concrete, stucco, and sometimes mortar for laying bricks. In metal stamping and cartridge-making operations, it is employed as a lubricant.

Probably the most important present-day use is in the plastics industry. Calcium stearate may be incorporated in the synthetic resin, or employed directly in the mould to prevent the moulded article from sticking. For this purpose the impalpably powdered material, with its exceptional fluffiness and freedom from moisture and impurities, is especially valuable. It has been used occasionally as a suspension and flatting agent in varnish manufacture; and a recent patent suggests its use in a water-paint composition. Calcium stearate has also been used to raise the melting point of wax. It has been mentioned in the literature as a diluent for Paris Green, as a blow-fly repellent, and as a constituent in ink formulation.

Zinc Stearate

Zinc stearate is a white, soft, fluffy amorphous powder, completely water-repellent. It does not form gels with solvents. When heated above its melting point in the presence of a solvent it seems to dissolve, but on cooling comes out of solution. In addition to its well-known use in cosmetics, it is used in the manufacture of crayons, linoleum and oil-cloth. It is also valuable in fireproofing compositions, medicinal preparations, and in the rubber industry. The paint and varnish industry finds it especially useful in lacquers of the sanding sealer type. Its use for coating stereotype matrices has been patented.

Magnesium Stearate

Magnesium stearate is a white to slightly yellowish-white, soft, light powder with a characteristic fatty odour. The technical grade is usually satisfactory for the paint and varnish industry, in which it is sometimes used as a flatting agent. The pure impalpably powdered material is useful as a dusting powder, and in medicinal preparations. The behaviour of magnesium stearate in thickening mineral oils and when dispersed in fatty acids, has been described. A patented mixture consisting of 1 part magnesium stearate, 2 parts alcohol, and a flame-modifying agent, is said to be useful as a special fuel.

Minor Stearates

Barium stearate is a white, crystalline powder, insoluble in alcohol. A colloidal gel obtained by heating it with carbon tetrachloride is claimed to be useful as a fire extinguisher. It catalyses the oxidation of organic compounds such as methyl alcohol and formaldehyde. A patent suggests its use in making varnishes, and raising the melting point of waxes.

Cobalt stearate, prepared from a double-pressed stearic acid, is a purple powder. It forms clear, translucent gels with naphthenic and paraffin base oils, and purple, translucent lubricating oils can be made with it.

Cupric stearate is a fine, fluffy, pale blue-green powder. When prepared by the method of Whitmore and Lauro, it has a melting point of 125° C. It is insoluble in water and soluble in ether, chloroform, benzol and turpentine. It may be added to soaps to confer antiseptic and germicidal properties. It has been employed in anti-fouling paints, and for bronzing purposes.

Ferric stearate is a fluffy, red-brown powder when made by the usual double decomposition method. When a vessel is filled with a solution of ferric stearate in benzene, drained, and the solvent allowed to evaporate, a non-wettable surface is formed, which, it is claimed, is not attacked by $N/10$ HCl, $N/10$ NaOH, saturated NaCl, ether, petroleum ether, chloroform, and methylene blue, when exposed for thirty minutes. A patent claims that a coating of ferric stearate on articles such as watch parts, prevents oil from spreading.

Lead stearate is a white, chalky, talc-like powder, melting at 115° C. to a clear liquid, and cooling to a white brittle solid. It is insoluble in ether and very slightly soluble in cold alcohol. It does dissolve, however, in hot alcohol, chloroform and hydrocarbons. Lead stearate has been used in the manufacture of matt varnishes, but large quantities retard the drying of varnish. It has also been suggested as a lubricant for ground-in stoppers.

A Non-Toxic Antiseptic

Mercuric stearate is a fine, white powder, melting at 112.2° C. It has the same antiseptic, germicidal and fungicidal properties as other mercury salts, but possesses the advantage of being non-toxic. For this reason, it has been suggested as an ingredient in dusting powders for wounds. Its use as a bactericide on paper money and other surfaces has been patented.

Nickel stearate is a light, greenish fluffy powder. When heated it decomposes partially, with the liberation of free stearic acid, and finally melts to a green liquid at about 100° C. It can be prepared in crystalline form by the use of solvents. According to Whitmore and Lauro, nickel soaps dissolved in benzene have good leathering and detergent qualities, which would suggest their application in the cleaning industry. Nickel stearate forms green translucent gels with mineral oils.

Silver stearate is a fine, white, odourless powder, melting above 200° C. with decomposition. This product, as well as other silver soaps, have been suggested as substitutes for argyrol and similar preparations.

Titanium stearate was prepared by Ryan and Plechner, by a novel method involving a reaction between stearic acid and titanium tetrachloride, in the presence of calcium carbonate. The product contained 6.5 per cent. titanium oxide and melted between 63.5° C. and 66° C. It was tested as an anti-settling agent for paints, and proved to be satisfactory.

General News

To save oil and textiles, men and women in war factories are to have the rags which they use to wipe their hands and machines laundered. The oil from the rag is to be extracted and returned to industry.

As is appropriate to-day, the latest issue of *Iodine Facts* (comprising Facts 144 to 207) is devoted to the hygiene of war. The booklet, which is of great interest and carefully indexed, can be obtained from the Iodine Educational Bureau, Stone House, Bishopsgate, E.C.2.

By standardising of parts and thus opening the way for mass production of producer-gas plants, Mr. J. V. Noel-Jorden, chairman of the Mobile Producer Gas Association, claims that 600,000 tons of petrol or 60 tanker journeys could be saved in twelve months.

Waste timber, which before the war was unmarketable, even as firewood, is now being turned into charcoal to help the war effort. Charcoal is essential for the processing of certain types of steel. Four charcoal stoves have been installed on a large estate in Yorkshire.

Aberdeen University Court at its meeting on July 15 decided to help the war effort by creating a new course for chemists. This summer vacation course will largely be used by students who have almost reached the Honours Degree stage, so that they may be released for specialised duty at as early a date as possible.

Laboratory control in paper mills was mentioned by Mr. F. L. T. Barlow, chairman of Wiggins, Teape and Co., in his speech last week at the annual meeting, when he thanked laboratory staffs for their good work. Not only has control been established at all their larger mills, but a research laboratory for the group is maintained at the largest mill, and a more specialised one at the photographic mill. Future investigations promise to be of great interest.

Foreign News

Gypsum production in Eire in 1941 amounted to 24,270 tons, valued at £7989. Output in 1939 was reported at 16,168 tons.

Production of fullers' earth in America increased in 1941 to 207,446 short tons from 146,568 tons in 1940, according to the Bureau of Mines.

A new aluminium plant, owned by the U.S. Government, has begun production at Massena, in New York. It will be operated by the Aluminium Company of America and was constructed in less than a year.

From Week to Week

Mr. Donald Nelson told senators in Washington last week that the production of synthetic rubber in the U.S., is expected to be 338,000 tons in 1943 and about double that amount in 1944. This year the production would be about 32,300 tons.

Duplication of its plant is announced by Zircon Rutile, Ltd., of Byron Bay, N.S.W. There is a large war-time demand for the company's products, and yet further extensions are under negotiation, to cope with growing requirements from America.

More intensive exploitation of shale-oil deposits in Estonia is indicated by reports that more workers will be required for this industry, which is now under Nazi control. These deposits were never of much importance, and the increased activity is a sign of oil shortage in Germany.

A new undertaking, styled Eternit Colombiana S.A., has been formed in Colombia with a capital of 900,000 pesos, for the manufacture of asbestos and cement products, the majority of shares being held by important Chilean interests and local cement manufacturers.

The Chilean Ambassador in Washington has been assured that the U.S. Maritime Board will place 340,000 tons of freight space at the disposal of Chilean nitrate interests for the months of July and August, and that approximately 900,000 tons will be available until June, 1943.

The alunite deposits at Lake Campion, near Merredin, Western Australia, are now to be developed, states Mr. A. R. G. Hawke, Minister for Industrial Development in that State. The deposits will provide one-third of the Commonwealth's potash requirements.

Canada is formulating plans to manufacture synthetic rubber from petroleum piped from United States oilfields, according to the U.S. Department of Commerce. Work on a plant to be erected in Sarnia, Ontario, the terminus of Imperial Oil's pipe line, will be started "as soon as possible," and is expected to be completed in 15 months.

Fish-liver oil, derived from the liver of the schnapper shark (a common fish in Victorian waters), is being produced by a Melbourne company with a capital of over £30,000. Technical researches have enabled the company to guarantee Australia's entire requirements of vitaminised oil—about 80,000 gallons a year. This is a new industry in the Commonwealth; it uses a product which hitherto went to waste, relieves the import pressure, and creates a new market for Victorian fishermen.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *— followed by the date of the Summary, but such total may have been reduced.)

BRITISH CELANESE, LTD., Torquay. (M., 25/7/42.) July 3, £120,000 and £12,000 debenture stock, part of amount already registered. *£2,786,481. Dec. 31, 1941.

PALORIT, LTD., London, N.W., varnish and paint manufacturers. (M., 25/7/42.) July 1, debenture and an assignment, both securing to Barclays Bank, Ltd., all moneys due or to become due to the Bank; general charge and charged on contract money. *Nil. Sept. 9, 1941.

Satisfaction

G. PIDDUCK AND CO., LTD., London, E.C., composition manufacturers. (M.S., 25/7/42.) Satisfaction July 4, of charge registered July 9, 1919.

Company Winding-up Voluntarily

ENGLISH GLUE MANUFACTURERS, LTD. (C.W.U.V., 25/7/42.) By special resolution June 30, W. J. Maltman, I.C.I. (General Chemicals), Ltd., Castner-Kellner Works, Runcorn, Cheshire, appointed liquidator.

Company News

Cellactite and British Uralite, Ltd., announce a profit, for the year ended March 31, of £7557 (£20,295). Last year's dividend was 25 per cent.

British Glues and Chemicals, Ltd., whose dividends have already been announced, report a net profit of £98,427 (£101,819) for the year ended April 30.

The directors of **Beechams Pills, Ltd.**, announce a record profit, for the year ended March 31, of £1,175,646 (£1,085,893). The dividend on the deferred capital is maintained at 28½ per cent. Of the subsidiary companies, **Eno Proprietaries** are paying an interim dividend of 18 per cent. (14.4 per cent.); **Veno Drug** report an interim of 1s 9d. on the deferred (1s. 10½d.); while **Yeast-Vite** announce an ordinary dividend of 82½ per cent. (60 per cent.); **A. F. Sherley and Co.** are paying 12 per cent. (nil); and **Prichard and Constance** 24 per cent. (98 per cent.).

The Metal Box Co., Ltd., has again declared a final dividend of 10 per cent. (making 15 per cent. for the year), plus a bonus of 2½ per cent. Profits, £210,369 against £199,705.

Chemical and Allied Stocks and Shares

WITH sentiment governed by the disposition to await further developments in the latest turn of the war, business in Stock Exchange markets has failed to show improvement. Nevertheless, in the absence of selling, moderate demand influenced prices, and in most sections, they were again higher on balance. At 33s. 1½d. Imperial Chemical more than held their recent improvement, while the 7 per cent. preference units have moved up from 33s. 10½d. to 34s. 1½d. at the time of writing. Firmness was maintained in B. Laporte, which were again quoted at 66s. 3d., while Fison Packard were 36s. 1½d. Business up to 20s. 4½d. has been recorded in Johnson Matthey 5 per cent. preference. Morgan Crucible 5 per cent. preference transferred at 22s. 9d. at one time, while elsewhere Monsanto Chemicals 5½ per cent. preference were again 22s. 6d. Preference shares have remained firmly held, and in many cases continue to be in very small supply, with the result that they may only be obtainable in any amount at higher prices than those indicated by current quotations. As usual, Lever and Unilever preference issues showed a fair amount of activity, the 8 per cents. were quoted at 28s. 9d. The ordinary units of the last-named company were higher at 28s. 9d., compared with 28s. a week ago, while among other active industrials which usually reflect the general market trend, Turner and Newall ordinary have improved to 68s. 1½d. at the time of writing, and Wall Paper Manufacturers deferred units were 27s. 3d.

Aided by the resumption of dividends, Richard Thomas ordinary have improved to 6s. 4½d.; the 6½ per cent. preference shares moved up to 29s. 6d. Stewarts and Lloyds were 46s. 3d., and Tube Investments 85s., while Guest Keen were 23s. 4½d., and United Steel 22s. 7½d. Following publication of the financial results, Metal Box shares have improved to 75s. 7½d., which compares with 74s. 4½d. a week ago. British Plaster Board were good on the annual meeting which drew attention to the widespread uses of the company's product; on balance the shares have moved up from 22s. 3d. to 24s. The annual statement of the Distillers Co. which mentioned further expansion of the chemical and allied sections of the business, drew attention to the ordinary units, which were 78s. 3d. compared with 76s. 6d. a week

(*Continued on page* 94.)

Deputation of Scientists

Demand for Establishment of a Board

ON Thursday last week the Government were asked by an influential deputation of scientists, M.P.s, and peers to set up a full-time scientific and technical joint board. This would have as its aim the fullest strategic use of scientific man-power and resources and the proper organisation and exchange of scientific and technical information relating to the war effort.

The deputation came from the Parliamentary and Scientific Committee (chairman, Capt. Leonard Plugge, M.P.), and among the eminent scientists represented on it were: Sir Lawrence Bragg, Mr. Hugh Linstead, M.P., Mr. C. S. Garland (British Association of Chemists), Professor W. Makower (Institute of Physics), Professor J. D. Bernal (Association of Scientific Workers), and Mr. Richard B. Pilcher (Institute of Chemistry).

Captain Plugge urged the importance of improving our scientific and technical approach to war problems. Abundant evidence existed of the need for some form of central scientific direction, which should be established without delay to ensure that the scientific resources of all departments associated with the war were effectively used.

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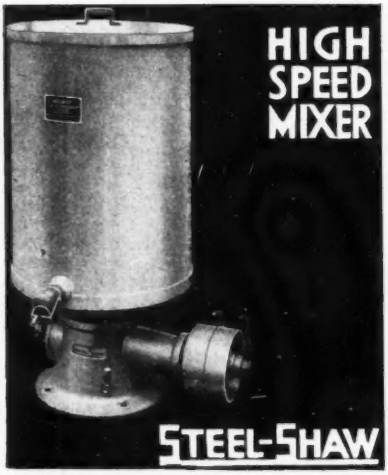

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ago. General Refractories at 11s. 3d. were within 3d. of the price ruling a week ago, and elsewhere United Premier Oil and Cake held their recent improvement to 7s. 9d. Borax Consolidated remained a firm feature at 31s. 3d., the market having continued hopeful that the dividend may be kept on a 7½ per cent. basis. British Glues and Chemicals 4s. shares were unchanged at 6s. 3d., aided by the good impression created by the report and accounts. Lawes Chemical were again quoted at 8s. 9d., and British Drug Houses at 18s. 9d., while Cellon 5s. shares were around 15s. 6d., and remained firmly held. Business up to 11s. 3d. was recorded in Goodlass Wall 10s. ordinary shares. British Aluminium at 43s. were within 3d. of the level current a week ago, while British Oxygen showed improvement from 64s. 9d. to 65s. 6d. United Molasses improved from 27s. 3d. to 27s. 10½d. British Industrial Plastics 2s. shares were higher at 4s. 6d.

The excellent financial results again achieved by Beechams Pills drew attention to the 2s. 6d. deferred shares, which improved in price to 12s. 1½d. On the other hand, Barry and Staines were lower on balance at 30s. 7½d., although Nairn and Greenwich remained at 51s. 3d. Movements among textile issues were mostly moderate, but attention continued to centre on British Celanese on hopes that a scheme may be impending to deal with the arrears of second preference dividend. Courtaulds were higher at 36s. 9d. In other directions, British Match remained at 34s. 3d., and Imperial Smelting were 10s. 6d., while Dunlop Rubber have improved to 27s. 9d. at the time of writing. Allied Ironfounders were 32s., and Amalgamated Metal 14s. 3d. Boots Drug were steady at 36s., Sangers 16s. 6d. and Timothy Whites 22s. 6d. Oil shares were better on balance in accordance with the general trend.

British Chemical Prices

Market Reports

TRADE in the general chemicals market during the past week has been governed chiefly by the supply position which still leaves much to be desired in many directions. Contract deliveries during the last few days have been on a satisfactory scale and a moderate volume of inquiry for fresh business has been circulating. Prices generally remain on a firm basis. A steady trade is reported in the soda products section with supplies of chlorate of soda and yellow prussiate of soda very scarce. Hyposulphite of soda is a strong market and there is a good call for bichromate of soda and nitrate of soda. Little change falls to be reported in the potash section, the demand for many items being far in excess of quantities available. Amongst the coal-tar products a steady demand is reported for carbolic acid crystals and creosote oil whilst there is a moderate trade in heavy and solvent naphthas. The toluols and benzols continue fairly active.

MANCHESTER.—To some extent industrial holidays in and around Manchester have exercised a seasonal influence on trade in chemicals in this area, though, on the whole, fair quantities of the leading heavy products are moving into consumption, chiefly against contracts, and prices generally are very firm. With regard to the by-products, new inquiry has been somewhat less in evidence, though there has been no lessening of any consequence in the demand for deliveries against orders already held, especially in the light materials and in carbolic and cresylic acids, tar and creosote oil.

GLASGOW.—The general position in the Scottish heavy chemical trade remains unchanged. Home business maintains its steady day-to-day transactions while export business is still rather restricted. Prices continue to keep firm.

Price Changes

Antimony Sulphide.—Golden, 1s. 2d. to 2s. 1½d. per lb. Crimson, 2s. 2d. to 2s. 6d. per lb.

Calcium Acetate.—MANCHESTER: Grey, £25 per ton.

Carbon Bisulphide.—£34 per ton, according to quality, in free returnable drums.

India Rubber Substitutes.—White, 6 3/16d. to 10½d. per lb.; dark, 6 3/16d. to 6 15/16d. per lb.

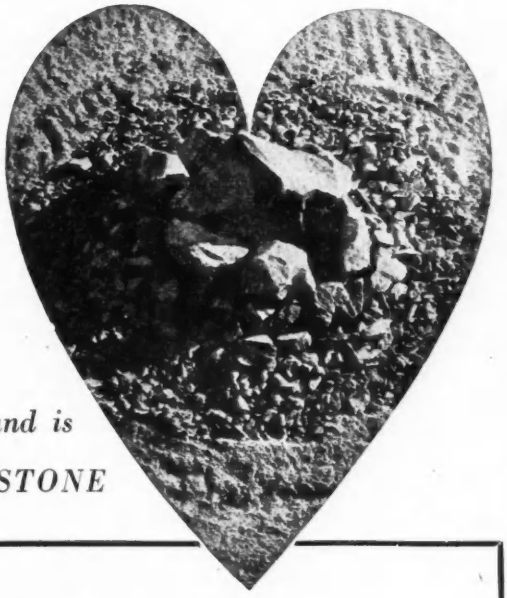
Lead, Red.—English, 5/10 cwt., £45 per ton; 10 cwt. to 1 ton, £44 15s.; 1/2 tons, £44 10s.; 2/5 tons, £44; 5/20 tons, £43 10s.; 20/100 tons, £43; over 100 tons, £42 10s. per ton, less 2½%, carriage paid, non-setting red lead, 10s. per ton dearer in each case.

Lead, White.—Dry English, less than 5 tons, £55 10s.; 5/15 tons, £51 10s.; 15/25 tons, £51; 25/50 tons, £50 10s.; 50/200 tons, £50 per ton, less 5 per cent. carriage paid; Continental material, £1 per ton cheaper. Ground in oil, English, 1/5 cwt., £67; 5/10 cwt., £66; 10 cwt. to 1 ton, £65 10s.; 1/2 tons, £64; 2/5 tons, £63; 5/10 tons, £61; 10/15 tons, £60; 15/25 tons, £59; 50/100 tons, £58 10s. per ton, less 5% carriage paid.

Pitch.—Medium, soft, 45s. to 55s. per ton, f.o.b. MANCHESTER: 45s. per ton at works.

Sodium Sulphate (Salt Cake).—MANCHESTER: £4 12s. 6d. per ton d/d station.

Xylol.—Commercial, 3s. 1d. to 3s. 5½d. per gal.; pure, 3s. 2½d. to 3s. 7d. MANCHESTER: 3s. 1d. to 3s. 3½d.



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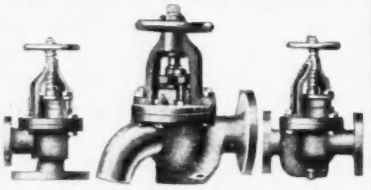

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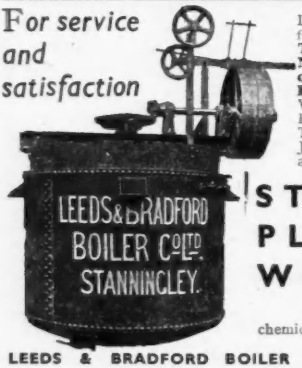

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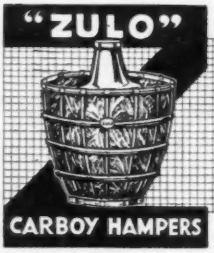

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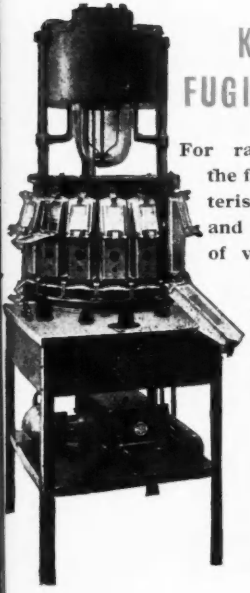

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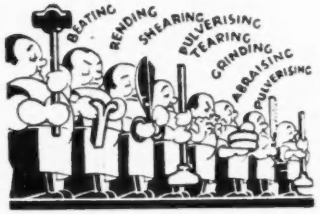

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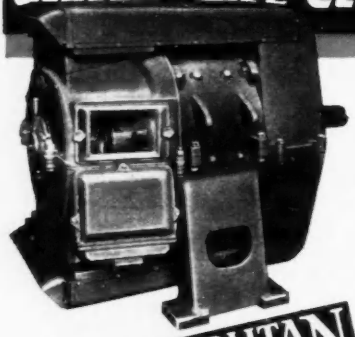

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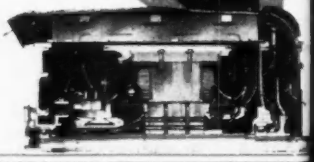

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